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Relevance scale ☐ ☐ ☐ ☐ ☐**1** [Consistency in a partitioned network: a survey](#)

Susan B. Davidson, Hector Garcia-Molina, Dale Skeen

September 1985 **ACM Computing Surveys (CSUR)**, Volume 17 Issue 3**Publisher:** ACM Press

Full text available: pdf(3.20 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Recently, several strategies have been proposed for transaction processing in partitioned distributed database systems with replicated data. These strategies are surveyed in light of the competing goals of maintaining correctness and achieving high availability. Extensions and combinations are then discussed, and guidelines are presented for selecting strategies for particular applications.

**2** [Monitoring distributed systems](#)

Jeffrey Joyce, Greg Lomow, Konrad Slind, Brian Unger

March 1987 **ACM Transactions on Computer Systems (TOCS)**, Volume 5 Issue 2**Publisher:** ACM Press

Full text available: pdf(2.37 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

The monitoring of distributed systems involves the collection, interpretation, and display of information concerning the interactions among concurrently executing processes. This information and its display can support the debugging, testing, performance evaluation, and dynamic documentation of distributed systems. General problems associated with monitoring are outlined in this paper, and the architecture of a general purpose, extensible, distributed monitoring system is presented. Three a ...

**3** [The LHAM log-structured history data access method](#)

Peter Muth, Patrick O'Neil, Achim Pick, Gerhard Weikum

February 2000 **The VLDB Journal — The International Journal on Very Large Data Bases**, Volume 8 Issue 3-4**Publisher:** Springer-Verlag New York, Inc.

Full text available: pdf(494.76 KB)

Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

Numerous applications such as stock market or medical information systems require that both historical and current data be logically integrated into a temporal database. The underlying access method must support different forms of "time-travel" queries, the migration of old record versions onto inexpensive archive media, and high insertion and update rates. This paper presents an access method for transaction-time temporal data, called the log-structured history data access method (L ...

**Keywords:** Data warehouses, Index structures, Performance, Storage systems, Temporal

databases

**4** A logical semantics for object-oriented databases

José Meseguer, Xiaolei Qian

June 1993 **ACM SIGMOD Record , Proceedings of the 1993 ACM SIGMOD international conference on Management of data SIGMOD '93**, Volume 22 Issue 2

Publisher: ACM Press

Full text available: pdf(1.15 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Although the mathematical foundations of relational databases are very well established, the state of affairs for object-oriented databases is much less satisfactory. We propose a semantic foundation for object-oriented databases based on a simple logic of change called rewriting logic, and a language called MaudeLog that is based on that logic. Some key advantages of our approach include its logical nature, its simplicity without any need for higher-order features, the fact ...

**5** Adaptive joint multiuser detection and channel estimation in multipath fading CDMA channels

Xiaodong Wang, H. Vincent Poor

November 1998 **Wireless Networks**, Volume 4 Issue 6

Publisher: Kluwer Academic Publishers

Full text available: pdf(387.24 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The problem of joint multiuser detection and channel estimation in frequency-selective Rayleigh fading CDMA channels is considered. First the optimal multiuser detector for such channels is derived, which is seen to have a computational complexity exponential in the product of the number of users and the length of the transmitted data sequence. Two suboptimal detectors are then developed and analyzed, both of which employ decorrelating filters at the front-ends to eliminate the multiple-access ...

**6** Documentation Project: Academic software resources

Carole (Kelly) Havens

November 1982 **Proceedings of the 10th annual ACM SIGUCCS conference on User services SIGUCCS '82**

Publisher: ACM Press

Full text available: pdf(246.13 KB)

Additional Information: [full citation](#), [abstract](#), [index terms](#)

Over a period of years, an academic user services group can go through enough personnel changes to cause a loss in continuity in documentation. As a result, hundreds of inadequately documented resources can accumulate, become obsolete, or come to exist in multiple copies and versions. User Services may find themselves having to rely on individual users or former staff to supply information on the more obscure resources. Their task, therefore, becomes the creation of a data bank of information ...

**7** The dangers of replication and a solution

Jim Gray, Pat Helland, Patrick O'Neil, Dennis Shasha

June 1996 **ACM SIGMOD Record , Proceedings of the 1996 ACM SIGMOD international conference on Management of data SIGMOD '96**, Volume 25 Issue 2

Publisher: ACM Press

Full text available: pdf(1.22 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Update anywhere-anytime-anyway transactional replication has unstable behavior as the workload scales up: a ten-fold increase in nodes and traffic gives a thousand fold increase in deadlocks or reconciliations. Master copy replication (primary copy) schemes reduce this problem. A simple analytic model demonstrates these results. A new two-tier replication algorithm is proposed that allows mobile (disconnected) applications to propose tentative update transactions that are later applied to a master ...

8 Revokable and versatile electronic money (extended abstract)

Markus Jakobsson, Moti Yung

January 1996 **Proceedings of the 3rd ACM conference on Computer and communications security CCS '96**

Publisher: ACM Press

Full text available: pdf(1.53 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)9 Multiversion divergence control of time fuzziness

Calton Pu, Miu K. Tsang, Kun-Lung Wu, Philip S. Yu

November 1994 **Proceedings of the third international conference on Information and knowledge management CIKM '94**

Publisher: ACM Press

Full text available: pdf(980.75 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Epsilon Serializability (ESR) has been proposed to manage and control inconsistency in extending the classic transaction processing. ESR increases system concurrency by tolerating a bounded amount of inconsistency. In this paper, we present multiversion divergence control (mvDC) algorithms that support ESR with not only value but also time fuzziness in multiversion databases. Unlike value fuzziness, accumulating time fuzziness is semantically different. A s ...

10 A class of replacement policies for medium and high-associativity structures

Yannick Deville, Jean Gobert

March 1992 **ACM SIGARCH Computer Architecture News**, Volume 20 Issue 1

Publisher: ACM Press

Full text available: pdf(1.03 MB) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

The content of set associative and fully associative structures (such as cache memories, TLBs and main memories) is controlled by a replacement algorithm. Replacing the elements that have not been accessed for a long period yields high performance. This property has been used in the LRU policy, it is also used in this paper, in order to define a new class of replacement policies that provide two improvements over LRU : 1) they exhibit higher performance, 2) they have a lower complexity of implem ...

11 Tuning garbage collection for reducing memory system energy in an embedded java environment

G. Chen, R. Shetty, M. Kandemir, N. Vijaykrishnan, M. J. Irwin, M. Wolczko

November 2002 **ACM Transactions on Embedded Computing Systems (TECS)**, Volume 1 Issue 1

Publisher: ACM Press

Full text available: pdf(740.23 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Java has been widely adopted as one of the software platforms for the seamless integration of diverse computing devices. Over the last year, there has been great momentum in adopting Java technology in devices such as cellphones, PDAs, and pagers where optimizing energy consumption is critical. Since, traditionally, the Java virtual machine (JVM), the cornerstone of Java technology, is tuned for performance, taking into account energy consumption requires reevaluation, and possibly redesign of t ...

**Keywords:** Garbage collector, Java Virtual Machine (JVM), K Virtual Machine (KVM), low power computing

12 Dribble posting a master file

Robert V. Head

February 1966 **Communications of the ACM**, Volume 9 Issue 2

**Publisher:** ACM PressFull text available: pdf(380.01 KB) Additional Information: [full citation](#), [abstract](#)

Many business applications employ sequential magnetic tape rather than random-access storage techniques to process a very small number of transactions against a voluminous master file. In such situations, it may prove economical to avoid creating a new master file during each updating run by producing instead a dribble ledger containing only those master file accounts which have experienced activity.

**13** Software for simulation

Jerry Banks

November 1996 **Proceedings of the 28th conference on Winter simulation WSC '96****Publisher:** ACM Press, IEEE Computer SocietyFull text available: pdf(908.02 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

This tutorial describes software for conducting computer simulation other software that supports simulation.

**14** A relational model of data for large shared data banks

E. F. Codd

June 1970 **Communications of the ACM**, Volume 13 Issue 6**Publisher:** ACM PressFull text available: pdf(1.27 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

Future users of large data banks must be protected from having to know how the data is organized in the machine (the internal representation). A prompting service which supplies such information is not a satisfactory solution. Activities of users at terminals and most application programs should remain unaffected when the internal representation of data is changed and even when some aspects of the external representation are changed. Changes in data representation will often be needed as a ...

**Keywords:** composition, consistency, data bank, data base, data integrity, data organization, data structure, derivability, hierarchies of data, join, networks of data, predicate calculus, redundancy, relations, retrieval language, security

**15** Authentication and signature schemes: On the performance, feasibility, and use of forward-secure signatures

Eric Cronin, Sugih Jamin, Tal Malkin, Patrick McDaniel

October 2003 **Proceedings of the 10th ACM conference on Computer and communications security CCS '03****Publisher:** ACM PressFull text available: pdf(386.51 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Forward-secure signatures (FSSs) have recently received much attention from the cryptographic theory community as a potentially realistic way to mitigate many of the difficulties digital signatures face with key exposure. However, no previous works have explored the practical performance of these proposed constructions in real-world applications, nor have they compared FSS to traditional, non-forward-secure, signatures in a non-asymptotic way. We present an empirical evaluation of several FSS sch ...


**Keywords:** digital signatures, forward-secure signatures

**16** Transportation, logistics, and distribution: An object-oriented paradigm for simulating postal distribution centers

K. Preston White, Brian Barney, Scott Keller, Robert Schwieters, Jacqueline Villasenor, William S. Terry, Richard G. Fairbrother, Richard D. Saxton

December 2001 **Proceedings of the 33rd conference on Winter simulation WSC '01**

**Publisher:** IEEE Computer Society

Full text available:  pdf(311.75 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Discrete-event simulation is an established tool for the design and management of large-scale mail sortation and distribution systems. Because the design of distribution facilities integrates many of the same or functionally similar components, adopting an object-oriented approach to simulation promises significant economies. Instead of coding and verifying models *de novo* for each facility, component subsystem, or individual process, object orientation allows engineers to reuse validated ...

17 A conservative algorithm for computing the flow of permissions in Java programs



Gleb Naumovich

July 2002 **ACM SIGSOFT Software Engineering Notes , Proceedings of the 2002 ACM SIGSOFT international symposium on Software testing and analysis ISSTA '02**, Volume 27 Issue 4

**Publisher:** ACM Press

Full text available:  pdf(540.08 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

Open distributed systems are becoming increasingly popular. Such systems include components that may be obtained from a number of different sources. For example, Java allows run-time loading of software components residing on remote machines. One unfortunate side-effect of this openness is the possibility that "hostile" software components may compromise the security of both the program and the system on which it runs. Java offers a built-in security mechanism, using which programmers can give p ...


**Keywords:** data flow analysis, java, security, static analysis, verification

18 Simulation of advanced manufacturing systems

Gerald W. Evans, William E. Biles, Michael W. Golway

December 1994 **Proceedings of the 26th conference on Winter simulation WSC '94**

**Publisher:** Society for Computer Simulation International

Full text available:  pdf(838.39 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

19 Use of parallel level 3 BLAS in LU factorization on three vector multiprocessors the




ALLIANT FX/80, the CRAY-2, and the IBM 3090 VF

M. J. Daydé, I. S. Duff

June 1990 **ACM SIGARCH Computer Architecture News , Proceedings of the 4th international conference on Supercomputing ICS '90**, Volume 18 Issue 3b

**Publisher:** ACM Press

Full text available:  pdf(1.22 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


We show how to transform the B-spline curve and surface fitting problems into suffix computations of continued fractions. Then a parallel substitution scheme is introduced to compute the suffix values on a newly proposed mesh-of-unshuffle network. The derived parallel algorithm allows the curve interpolation through  $n$  points to be solved in  $O(n \log n)$  time using  $n/\log n$  processors and allows the surface interpolati ...

20 The relational model for database management: version 2

E. F. Codd

January 1990 Book

**Publisher:** Addison-Wesley Longman Publishing Co., Inc.

Full text available:  pdf(28.61 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

**From the Preface (See Front Matter for full Preface)**





An important adjunct to precision is a sound theoretical foundation. The relational model is solidly based on two parts of mathematics: firstorder predicate logic and the theory of relations. This book, however, does not dwell on the theoretical foundations, but rather on all the features of the relational model that I now perceive as important for database users, and therefore for DBMS vendors. My perceptions result from 20 y ...

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### 1 [Distributed operating systems](#)



Andrew S. Tanenbaum, Robbert Van Renesse

 December 1985 **ACM Computing Surveys (CSUR)**, Volume 17 Issue 4

Publisher: ACM Press

 Full text available: [pdf\(5.49 MB\)](#)

 Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Distributed operating systems have many aspects in common with centralized ones, but they also differ in certain ways. This paper is intended as an introduction to distributed operating systems, and especially to current university research about them. After a discussion of what constitutes a distributed operating system and how it is distinguished from a computer network, various key design issues are discussed. Then several examples of current research projects are examined in some detail ...

### 2 [An intrusion tolerant architecture for dynamic content internet servers](#)



Ayda Saidane, Yves Deswarte, Vincent Nicomette

 October 2003 **Proceedings of the 2003 ACM workshop on Survivable and self-regenerative systems: in association with 10th ACM Conference on Computer and Communications Security SSRS '03**

Publisher: ACM Press

 Full text available: [pdf\(551.49 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#)

This paper describes a generic architecture for intrusion tolerant Internet servers. It aims to build systems that are able to survive attacks in the context of an open network such as the Internet. To do so, the design is based on fault tolerance techniques, in particular redundancy and diversification. These techniques give a system the additional resources to continue delivering the correct service to its legitimate clients even when active attacks are corrupting parts of the system compon ...

**Keywords:** adaptive redundancy, fault tolerance, intrusion tolerance

### 3 [Understanding fault-tolerant distributed systems](#)



Flavin Cristian

 February 1991 **Communications of the ACM**, Volume 34 Issue 2

Publisher: ACM Press

 Full text available: [pdf\(6.17 MB\)](#)

 Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#), [review](#)

### 4 [From group communication to transactions in distributed systems](#)



André Schiper, Michel Raynal

April 1996 **Communications of the ACM**, Volume 39 Issue 4**Publisher:** ACM PressFull text available: pdf(165.96 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

5 Approaches to fault-tolerant and transactional mobile agent execution---an algorithmic view



Stefan Pleisch, André Schiper

September 2004 **ACM Computing Surveys (CSUR)**, Volume 36 Issue 3**Publisher:** ACM PressFull text available: pdf(946.94 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Over the past years, mobile agent technology has attracted considerable attention, and a significant body of literature has been published. To further develop mobile agent technology, reliability mechanisms such as fault tolerance and transaction support are required. This article aims at structuring the field of fault-tolerant and transactional mobile agent execution and thus at guiding the reader to understand the basic strengths and weaknesses of existing approaches. It starts with a discus ...

**Keywords:** ACID, Byzantine failures, agreement problem, asynchronous system, commit, crash failures, fault tolerance, malicious places, mobile agents, replication, security, transaction

6 A Survey of Techniques for Synchronization and Recovery in Decentralized Computer Systems



Walter H. Kohler

June 1981 **ACM Computing Surveys (CSUR)**, Volume 13 Issue 2**Publisher:** ACM PressFull text available: pdf(3.33 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

7 The relational model for database management: version 2



E. F. Codd

January 1990 Book

**Publisher:** Addison-Wesley Longman Publishing Co., Inc.Full text available: pdf(28.61 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

**From the Preface (See Front Matter for full Preface)**

An important adjunct to precision is a sound theoretical foundation. The relational model is solidly based on two parts of mathematics: firstorder predicate logic and the theory of relations. This book, however, does not dwell on the theoretical foundations, but rather on all the features of the relational model that I now perceive as important for database users, and therefore for DBMS vendors. My perceptions result from 20 y ...

8 Programming languages for distributed computing systems



Henri E. Bal, Jennifer G. Steiner, Andrew S. Tanenbaum

September 1989 **ACM Computing Surveys (CSUR)**, Volume 21 Issue 3**Publisher:** ACM PressFull text available: pdf(6.50 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

When distributed systems first appeared, they were programmed in traditional sequential languages, usually with the addition of a few library procedures for sending and receiving messages. As distributed applications became more commonplace and more



sophisticated, this ad hoc approach became less satisfactory. Researchers all over the world began designing new programming languages specifically for implementing distributed applications. These languages and their history, their underlying pr ...

### 9 Continuous learning: a design methodology for fault-tolerant neural networks



Vincenzo Piuri

June 1990 **Proceedings of the 3rd international conference on Industrial and engineering applications of artificial intelligence and expert systems - Volume 2 IEA/AIE '90**

**Publisher:** ACM Press

Full text available: pdf(1.36 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Fault tolerance in artificial neural networks is an important feature, in particular when the application is critical or when maintenance is difficult. This paper presents a general design methodology for designing fault-tolerant architectures, starting from the behavioral description of the nominal network and from the nominal algorithm. The behavioral level is considered to detect errors due to hardware faults, while system survival is guaranteed by the reactivation of learning mechanisms ...

### 10 Providing fault-tolerant services to distributed Ada 95 applications



Yvon Kermarrec, Laurent Nana, Laurent Pautet

December 1996 **Proceedings of the conference on TRI-Ada '96: disciplined software development with Ada TRI-Ada '96**

**Publisher:** ACM Press

Full text available: pdf(837.05 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

### 11 Totem: a fault-tolerant multicast group communication system



L. E. Moser, P. M. Melliar-Smith, D. A. Agarwal, R. K. Budhia, C. A. Lingley-Papadopoulos

April 1996 **Communications of the ACM**, Volume 39 Issue 4

**Publisher:** ACM Press

Full text available: pdf(342.07 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#), [review](#)

### 12 Ariadne—an adaptive router for fault-tolerant multicomputers



J. D. Allen, P. T. Gaughan, D. E. Schimmel, S. Yalamanchili

April 1994 **ACM SIGARCH Computer Architecture News , Proceedings of the 21ST annual international symposium on Computer architecture ISCA '94**, Volume 22 Issue 2

**Publisher:** IEEE Computer Society Press, ACM Press

Full text available: pdf(1.21 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Adaptive routing has been proposed as a means of improving performance and fault-tolerance in multicomputer networks. While a number of algorithms have been proposed, few adaptive routers have been implemented in hardware. This paper presents the design and implementation of Ariadne --- a prototype single chip, hardware router. The primary motivation is tolerance to link and router failures, while reconciling conflicting demands on performance. This is achieved by implementing the *m*-misro ...

### 13 The process group approach to reliable distributed computing



Kenneth P. Birman

December 1993 **Communications of the ACM**, Volume 36 Issue 12

**Publisher:** ACM Press

Full text available: pdf(6.00 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** fault-tolerant process groups, message ordering, multicast communication

14 Prototyping, verification, and test: Reducing pin and area overhead in fault-tolerant FPGA-based designs



Fernanda Lima, Luigi Carro, Ricardo Reis

February 2003 **Proceedings of the 2003 ACM/SIGDA eleventh international symposium on Field programmable gate arrays FPGA '03**

**Publisher:** ACM Press

Full text available: pdf(328.13 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper proposes a new high-level technique for designing fault tolerant systems in SRAM-based FPGAs, without modifications in the FPGA architecture. Traditionally, TMR has been successfully applied in FPGAs to mitigate transient faults, which are likely to occur in space applications. However, TMR comes with high area and power dissipation penalties. The proposed technique was specifically developed for FPGAs to cope with transient faults in the user combinational and sequential logic, while ...

**Keywords:** FPGA, fault-tolerance

15 Parity logging overcoming the small write problem in redundant disk arrays



Daniel Stodolsky, Garth Gibson, Mark Holland

May 1993 **ACM SIGARCH Computer Architecture News , Proceedings of the 20th annual international symposium on Computer architecture ISCA '93**, Volume 21 Issue 2

**Publisher:** ACM Press

Full text available: pdf(1.35 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Parity encoded redundant disk arrays provide highly reliable, cost effective secondary storage with high performance for read accesses and large write accesses. Their performance on small writes, however, is much worse than mirrored disks—the traditional, highly reliable, but expensive organization for secondary storage. Unfortunately, small writes are a substantial portion of the I/O workload of many important, demanding applications such as on-line transaction processing. This paper ...

16 Session 2B: Sorting and searching in the presence of memory faults (without redundancy)



Irene Finocchi, Giuseppe F. Italiano

June 2004 **Proceedings of the thirty-sixth annual ACM symposium on Theory of computing STOC '04**

**Publisher:** ACM Press

Full text available: pdf(219.59 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We investigate the design of algorithms resilient to memory faults, i. e., algorithms that, despite the corruption of some memory values during their execution, are able to produce a correct output on the set of uncorrupted values. In this framework, we consider two fundamental problems: sorting and searching. In particular, we prove that any  $O(n \log n)$  comparison-based sorting algorithm can tolerate at most  $O((n \log n)^{1/2})$  memory faults. Furthermore, we present one comparison-based sor ...

**Keywords:** combinatorial algorithms, memory faults, memory models, searching, sorting

17 ReVive: cost-effective architectural support for rollback recovery in shared-memory multiprocessors





Milos Prvulovic, Zheng Zhang, Josep Torrellas

May 2002 **ACM SIGARCH Computer Architecture News , Proceedings of the 29th annual international symposium on Computer architecture ISCA '02**

**Proceedings of the 29th annual international symposium on Computer  
architecture ISCA '02**, Volume 30 Issue 2

**Publisher:** IEEE Computer Society, ACM Press

Full text available:  pdf(1.38 MB)  Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)  
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This paper presents ReVive, a novel general-purpose rollback recovery mechanism for shared-memory multiprocessors. ReVive carefully balances the conflicting requirements of availability, performance, and hardware cost. ReVive performs checkpointing, logging, and distributed parity protection, all memory-based. It enables recovery from a wide class of errors, including the permanent loss of an entire node. To maintain high performance, ReVive includes specialized hardware that performs frequent o ...

**Keywords:** fault tolerance, shared-memory multiprocessors, rollback recovery, recovery, BER, logging, parity, checkpointing, availability

**18** [Some aspects of the GOTHIC system](#)



J. P. Banatre, M. Banatre

September 1986 **Proceedings of the 2nd workshop on Making distributed systems  
work EW 2**

**Publisher:** ACM Press

Full text available:  pdf(250.12 KB) Additional Information: [full citation](#), [abstract](#), [references](#)

This note gives a short presentation of a distributed system currently under development [BANA-86a]. This system is structured according to the concept of atomic multi-procedure (section 2) and allows the handling of replicated and fragmented objects. The supporting architecture is a pluri-processor enriched with stable storage facilities (section 3).

**19** [Reliability Issues in Computing System Design](#)



B. Randell, P. Lee, P. C. Treleaven

June 1978 **ACM Computing Surveys (CSUR)**, Volume 10 Issue 2

**Publisher:** ACM Press

Full text available:  pdf(3.95 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)


**20** [Parity logging disk arrays](#)



Daniel Stodolsky, Mark Holland, William V. Courtright, Garth A. Gibson

August 1994 **ACM Transactions on Computer Systems (TOCS)**, Volume 12 Issue 3

**Publisher:** ACM Press

Full text available:  pdf(1.98 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Parity-encoded redundant disk arrays provide highly reliable, cost-effective secondary storage with high performance for reads and large writes. Their performance on small writes, however, is much worse than mirrored disks—the traditional, highly reliable, but expensive organization for secondary storage. Unfortunately, small writes are a substantial portion of the I/O workload of many important, demanding applications such as on-line transaction processing. This paper presents

**Keywords:** RAID, disk arrays

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examples of current research projects are examined in some detail ...

#### 4 ReVive: cost-effective architectural support for rollback recovery in shared-memory multiprocessors

Milos Prvulovic, Zheng Zhang, Josep Torrellas

May 2002 **ACM SIGARCH Computer Architecture News , Proceedings of the 29th annual international symposium on Computer architecture ISCA '02 , Proceedings of the 29th annual international symposium on Computer architecture ISCA '02**, Volume 30 Issue 2

**Publisher:** IEEE Computer Society, ACM Press

Full text available:  [pdf\(1.38 MB\)](#)  Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)  
[Publisher Site](#)

This paper presents ReVive, a novel general-purpose rollback recovery mechanism for shared-memory multiprocessors. ReVive carefully balances the conflicting requirements of availability, performance, and hardware cost. ReVive performs checkpointing, logging, and distributed parity protection, all memory-based. It enables recovery from a wide class of errors, including the permanent loss of an entire node. To maintain high performance, ReVive includes specialized hardware that performs frequent o ...

**Keywords:** fault tolerance, shared-memory multiprocessors, rollback recovery, recovery, BER, logging, parity, checkpointing, availability

#### 5 Cluster-based scalable network services

Armando Fox, Steven D. Gribble, Yatin Chawathe, Eric A. Brewer, Paul Gauthier

October 1997 **ACM SIGOPS Operating Systems Review , Proceedings of the sixteenth ACM symposium on Operating systems principles SOSP '97**, Volume 31 Issue 5

**Publisher:** ACM Press

Full text available:  [pdf\(2.42 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

#### 6 Enterprise information architectures—they're finally changing

Wesley P. Melling

May 1994 **ACM SIGMOD Record , Proceedings of the 1994 ACM SIGMOD international conference on Management of data SIGMOD '94**, Volume 23 Issue 2

**Publisher:** ACM Press

Full text available:  [pdf\(1.28 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Substantive changes in the business environment—and aggressive initiatives in business process reengineering—are driving corresponding changes in the information technology architectures of large enterprises. Those changes are enabled by the convergence of a long list of maturing new technologies. As one of its many implications, the new IT architecture demands revised assumptions about the design and deployment of databases. This paper reviews the components of the architecture ...

#### 7 Microcode implemented General Modular Redundancy

F. P. Mathur, P. T. de Sousa

September 1974 **Conference record of the 7th annual workshop on Microprogramming MICRO 7**

**Publisher:** ACM Press

Full text available:  [pdf\(519.37 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

First the concepts of protective redundancy are described in the unified framework called General Modular Redundancy (GMR). GMR is a unified framework which synthesizes all the major redundancy techniques known. An alternative to an exclusively hardware implementation is by means of an extension to the Wensleyian Software Implemented Fault-Tolerance (SIFT) approach. A more attractive alternative, an implementation in microcode, is proposed and described here.

8 CRUSADE: hardware/software co-synthesis of dynamically reconfigurable heterogeneous real-time distributed embedded systems

Bharat P. Dave

January 1999 **Proceedings of the conference on Design, automation and test in Europe DATE '99**

**Publisher:** ACM Press


Full text available:  pdf(59.35 KB) Additional Information: [full citation](#), [citations](#), [index terms](#)

9 A taxonomy of computer program security flaws

Carl E. Landwehr, Alan R. Bull, John P. McDermott, William S. Choi

September 1994 **ACM Computing Surveys (CSUR)**, Volume 26 Issue 3

**Publisher:** ACM Press

Full text available:  pdf(3.81 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

An organized record of actual flaws can be useful to computer system designers, programmers, analysts, administrators, and users. This survey provides a taxonomy for computer program security flaws, with an Appendix that documents 50 actual security flaws. These flaws have all been described previously in the open literature, but in widely separated places. For those new to the field of computer security, they provide a good introduction to the characteristics of security flaws and how they ...


**Keywords:** error/defect classification, security flaw, taxonomy

10 Risks to the public: Risks to the public

Peter G. Neumann

May 2005 **ACM SIGSOFT Software Engineering Notes**, Volume 30 Issue 3

**Publisher:** ACM Press

Full text available:  pdf(177.87 KB) Additional Information: [full citation](#), [abstract](#), [index terms](#)


Edited by Peter G. Neumann (Risks Forum Moderator and Chairman of the ACM Committee on Computers and Public Policy), plus personal contributions by others, as indicated. Opinions expressed are individual rather than organizational, and all of the usual disclaimers apply. We address problems relating to software, hardware, people, and other circumstances relating to computer systems. To economize on space, we include pointers to items in the online Risks Forum: (R i j) denotes RISKS vol i number ...

11 Structured programming using processes

Jay Nelson

September 2004 **Proceedings of the 2004 ACM SIGPLAN workshop on Erlang ERLANG '04**



**Publisher:** ACM Press

Full text available:  pdf(116.57 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Structured Programming techniques are applied to a personal accounting software application implemented in erlang as a demonstration of the utility of processes as design constructs. Techniques for enforcing strong encapsulation, partitioning for fault isolation and data flow instrumentation, reusing code, abstracting and adapting interfaces, simulating inputs, managing and distributing resources and creating complex application behavior are described. The concept of *inductive decomposition*



**Keywords:** COPL, concurrency oriented programming language, erlang, inductive decomposition

12 Risks to the public

-  P. G. Neumann  
October 1990 **ACM SIGSOFT Software Engineering Notes**, Volume 15 Issue 5  
**Publisher:** ACM Press  
Full text available:  [pdf\(1.56 MB\)](#) Additional Information: [full citation](#), [index terms](#)



13 Risks to the public in computers and related systems



-  Peter G. Neumann  
July 1991 **ACM SIGSOFT Software Engineering Notes**, Volume 16 Issue 3  
**Publisher:** ACM Press  
Full text available:  [pdf\(2.79 MB\)](#) Additional Information: [full citation](#), [index terms](#)

14 Multiview access protocols for large-scale replication





-  Xiangning Liu, Abdelsalam Helal, Weimin Du  
June 1998 **ACM Transactions on Database Systems (TODS)**, Volume 23 Issue 2  
**Publisher:** ACM Press  
Full text available:  [pdf\(365.98 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

The article proposes a scalable protocol for replication management in large-scale replicated systems. The protocol organizes sites and data replicas into a tree-structured, hierarchical cluster architecture. The basic idea of the protocol is to accomplish the complex task of updating replicated data with a very large number of replicas by a set of related but independently committed transactions. Each transaction is responsible for updating replicas in exactly one cluster and invoking add ...

**Keywords:** data replication, large-scale systems, multiview access



15 Frontmatter (TOC, Letters, Election results, Software Reliability Resources!, Computing Curricula 2004 and the Software Engineering Volume SE2004, Software Reuse Research, ICSE 2005 Forward)



-  July 2005 **ACM SIGSOFT Software Engineering Notes**, Volume 30 Issue 4  
**Publisher:** ACM Press  
Full text available:  [pdf\(6.19 MB\)](#) Additional Information: [full citation](#), [index terms](#)



16 Risks to the public in computer systems



-  Peter G. Neumann  
October 1986 **ACM SIGSOFT Software Engineering Notes**, Volume 11 Issue 5  
**Publisher:** ACM Press  
Full text available:  [pdf\(2.19 MB\)](#) Additional Information: [full citation](#), [index terms](#)

17 The Information Bus: an architecture for extensible distributed systems



-  Brian Oki, Manfred Pfluegl, Alex Siegel, Dale Skeen  
December 1993 **ACM SIGOPS Operating Systems Review , Proceedings of the fourteenth ACM symposium on Operating systems principles SOSP '93**, Volume 27 Issue 5  
**Publisher:** ACM Press  
Full text available:  [pdf\(1.12 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Research can rarely be performed on large-scale, distributed systems at the level of thousands of workstations. In this paper, we describe the motivating constraints, design



principles, and architecture for an extensible, distributed system operating in such an environment. The constraints include continuous operation, dynamic system evolution, and integration with extant systems. The *Information Bus*, our solution, is a novel synthesis of four design principles: core communication protocols ...

### 18 TIGRA — an architectural style for enterprise application integration

Wolfgang Emmerich, Ernst Ellmer, Henry Fieglein


July 2001 **Proceedings of the 23rd International Conference on Software Engineering ICSE '01**

**Publisher:** IEEE Computer Society

Full text available:  [pdf\(137.99 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)  
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We report on experience that we made in the Trading room InteGRation Architecture project (TIGRA) at a large German bank. TIGRA developed a distributed system architecture for integrating different financial front-office trading systems with middle- and back-office applications. We generalize the experience by proposing an architectural style that can be re-used for similar enterprise application integration tasks. The TIGRA style is based on a separation of data representation using domain-s ...

### 19 Session 17: architecture: Architecture of the VPP500 parallel supercomputer

 Teruo Utsumi, Masayuki Ikeda, Moriyuki Takamura

November 1994 **Proceedings of the 1994 ACM/IEEE conference on Supercomputing Supercomputing '94**

**Publisher:** ACM Press

Full text available:  [pdf\(719.76 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#)

The VPP500 vector parallel processor is a highly parallel, distributed memory supercomputer that has a performance range of 6.4 to 355 gigaFLOPS and a main memory capacity from 1 to 222 gigabytes. The system scalably supports between 4 and 222 processors interconnected by a high-bandwidth crossbar network. Three key aspects of the VPP500, which are in sharp contrast to current massively parallel systems, characterize its architecture. First the building block is a 1.6 gigaFLOPS vector processor t ...

### 20 Charles W. Bachman interview: September 25-26, 2004; Tucson, Arizona

 Thomas Haigh  
January 2006 **ACM Oral History interviews**

**Publisher:** ACM Press

Full text available:  [pdf\(761.66 KB\)](#) Additional Information: [full citation](#), [abstract](#)

Charles W. Bachman reviews his career. Born during 1924 in Kansas, Bachman attended high school in East Lansing, Michigan before joining the Army Anti Aircraft Artillery Corp, with which he spent two years in the Southwest Pacific Theater, during World War II. After his discharge from the military, Bachman earned a B.Sc. in Mechanical Engineering in 1948, followed immediately by an M.Sc. in the same discipline, from the University of Pennsylvania. On graduation, he went to work for Do ...

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IEEE STD IEEE Standard

- ☐ 1. **An adaptive update lifting scheme with perfect reconstruction**  
 Piella, G.; Heijmans, H.J.A.M.;  
[Image Processing, 2001. Proceedings. 2001 International Conference on](#)  
 Volume 3, 7-10 Oct. 2001 Page(s):190 - 193 vol.3  
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 Gordy, J.D.; Goubran, R.A.;  
[Acoustics, Speech, and Signal Processing, 2004. Proceedings. \(ICASSP '04\). IEEE International Conference on](#)  
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 Jeppesen, M.; Rodbro, C.A.; Jensen, S.H.;  
[Acoustics, Speech, and Signal Processing, 2001. Proceedings. \(ICASSP '01\). 2001 IEEE International Conference on](#)  
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- ☐ 5. **Nonlinear discrete-time reconfigurable flight control law using neural networks**  
 Dong-Ho Shin; Youdan Kim;  
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- ☐ **6. Adaptive frequency selective filters**  
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Digital Object Identifier 10.1109/ACSSC.1993.342347  
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Hongbin Li;  
Signal Processing Magazine, IEEE  
Volume 24, Issue 1, Jan. 2007 Page(s):148 - 150  
Digital Object Identifier 10.1109/MSP.2007.273066  
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- ☐ **8. Complexity reduction and regularization of a fast affine projection algorithm for oversampled subband adaptive filters**  
Chau, E.; Sheikhzadeh, H.; Brennan, R.L.;  
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Volume 5, 17-21 May 2004 Page(s):V - 109-12 vol.5  
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White, R.V.; Miles, F.M.;  
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- ☐ **7. Architectural challenges for "ambient dependability"**  
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[0024] In an embodiment in accordance with the present invention, the **fault-tolerant update agent 117** may employ the working **bank 125** in the volatile memory ...  
[www.freepatentsonline.com/20040123282.html](http://www.freepatentsonline.com/20040123282.html) - 59k - [Cached](#) - [Similar pages](#)

**Method for fault tolerant updating of an electronic device - US ...**

Method for **fault tolerant** updating of an electronic device - US Patent 7082549 ... The method of claim 6 wherein the **update package** comprises a **bank order** ...  
[www.patentstorm.us/patents/7082549-claims.html](http://www.patentstorm.us/patents/7082549-claims.html) - 28k - [Cached](#) - [Similar pages](#)

**Method for fault tolerant updating of an electronic device - US ...**

Method for **fault tolerant** updating of an electronic device - US Patent 7082549 ... The **bank order** of the conversion may be specified in the **update package**, ...  
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**[PDF] Architecture of fault-tolerant multiprocessor workstations ...**

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**fault-tolerant** multiprocessor architecture based on standard processors associated ...  
access memory [BANA-881, each **bank** consisting possibly of several ...  
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**[PDF] Portable controlling software package for parallel fault-tolerant ...**

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**bank**, and the slaves, slave control, **fault tolerance**, sequential ... The master will **update** slave status after each checking. ...  
[ieeexplore.ieee.org/iel2/1063/7689/00319957.pdf?arnumber=319957](http://ieeexplore.ieee.org/iel2/1063/7689/00319957.pdf?arnumber=319957) - [Similar pages](#)  
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Organization of the **fault-tolerant** open distributed system. Figure 3..Node architecture. ...  
that **update** the **bank** accounts. Howe- ...  
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**[PS] Microsoft PowerPoint - 16 Lec Fault tolerance**File Format: Adobe PostScript - [View as Text](#)

**Fault-tolerant** banking system. - two **bank** accounts x & y, initially 0 ... if the request is an **update**, the updated state and unique id ...  
[www.cs.bham.ac.uk/~mzk/courses/DistSys/lec16.ps](http://www.cs.bham.ac.uk/~mzk/courses/DistSys/lec16.ps) - [Similar pages](#)

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cache **bank** and the backup **bank** make up a **fault-tolerant** memory subsystem ... The write-through bus permits F-CMP to use a write-**update** coherence protocol to ...  
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**fault-tolerance and novell edirectory and novell inc. Resources on ...**

**fault-tolerance** and novell edirectory and novell inc. (1 results) ... The **bank** wanted to establish itself as the leader in Internet banking and double its ...  
[search.techrepublic.com.com/search/fault-tolerance+and+novell+edirectory+and+novell+inc..html](http://search.techrepublic.com.com/search/fault-tolerance+and+novell+edirectory+and+novell+inc..html) - 51k - [Cached](#) - [Similar pages](#)

**Fault-Tolerant Servers**

Determine whether clustering or **fault tolerance** is a better solution for your ... These servers have user-replaceable component modules that let a **bank** ...

[www.windowsitpro.com/Windows/Article/ArticleID/27403/27403.html](http://www.windowsitpro.com/Windows/Article/ArticleID/27403/27403.html) - Apr 24, 2007 -

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A summary of the features of the new ftServer W Series 5700 **fault-tolerant** Windows-based server with dual-core processors and online **upgrade** technology. ...

[www.stratus.com/news/stranews/](http://www.stratus.com/news/stranews/) - 20k - [Cached](#) - [Similar pages](#)

**Avaya to Help China's Central Bank Upgrade Network**

Avaya to Help China's Central **Bank Upgrade** Network ... It delivers a backplane capacity of 55 Gbps as well as **fault tolerant** power, switch, ...

[www.avaya.com/gcm/master-usa/en-us/corporate/pressroom/pressreleases/2002/pr-021213.htm](http://www.avaya.com/gcm/master-usa/en-us/corporate/pressroom/pressreleases/2002/pr-021213.htm) - 45k - [Cached](#) - [Similar pages](#)

**Bank Brussels Lambert advances network for electronic banking ...**

The **bank** first introduced **fault tolerance** into its network in 1988 when it ... The **bank** soon will **upgrade** the 300 to a more powerful model and convert ...

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Everbright's mail server performs well on the NEC **Fault Tolerant** solution. Situation Overview ... It has interests in China Everbright **Bank** and China ...

[www.nec.co.jp/express/products/f\\_fault\\_tolerant/NEC\\_Everbright.pdf](http://www.nec.co.jp/express/products/f_fault_tolerant/NEC_Everbright.pdf) - [Similar pages](#)

**Techworld.com - NEC cuts the cost of fault-tolerance**

In a bid to get more people to buy **fault-tolerant** servers, NEC has launched a ... That might involve a reboot as part of an operating system **upgrade**. ...

[www.techworld.com/opsys/news/index.cfm?newsid=7790](http://www.techworld.com/opsys/news/index.cfm?newsid=7790) - 55k - [Cached](#) - [Similar pages](#)

**[PDF] Multiprocessor Architecture Using an Audit Trail for Fault Tolerance**

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for **Fault Tolerance** on a Tightly-Coupled Multiprocessor", technical. report: csl-tr-99-776, ... Negative Acknowledgments and **Upgrade** Misses for DRSM-L ...

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**Fault Tolerant** Server. NEC Express5800/ft series. Aozora **Bank** renewed its information system with a ... continue to **upgrade** our system at the. minimum ...

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**Computerworld - NEC rolls out low-cost fault tolerant server**

Active **Upgrade** comes standard with NEC's more expensive servers. ... NEC partnered with Stratus to bring the **fault tolerant** design to lower-priced, ...

[www.computerworld.com.au/index.php/id;1384861052](http://www.computerworld.com.au/index.php/id;1384861052) - [Similar pages](#)

**[PDF] Special Offer - Stratus Fault-Tolerant 4300 Server with an ArcGIS ...**

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**Upgrade** One-Year System Availability Service in Package Price to ... Stratus **Fault-Tolerant** Dual CPU 4300 Server and ArcGIS Server 9.2 Basic Enterprise— ...

[www.esri.com/partners/hardware/stratus-basic.pdf](http://www.esri.com/partners/hardware/stratus-basic.pdf) - [Similar pages](#)

**Schneier on Security: Triple-DES Upgrade Adding Insecurities?**

I have an account at a **bank** whose ATM's only allow 4 digits to be entered. ... Throw in a bunch of other reasons too; mission-critical **fault-tolerant** ...

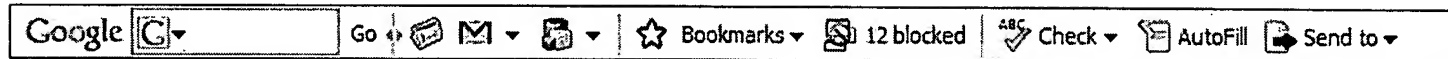
<http://www.google.com/search?hl=en&q=upgrade+bank+fault+tolerant>

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Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	121	shift\$4 with bank same (updat\$4 upgrad\$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:20
L2	17	(updat\$4 upgrad\$4) with bank same (fault adj tolerant)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:22
L3	294	(updat\$4 upgrad\$4) with (software firmware) with version with (bank memory )	US-PGPUB	OR	ON	2007/04/25 08:23
L4	46	(updat\$4 upgrad\$4) with (software firmware) with version with (bank memory ).clm.	US-PGPUB	OR	ON	2007/04/25 08:25
L7	56	(updat\$4 upgrad\$4) same (memory bank storage) same code with version.clm.	US-PGPUB	OR	ON	2007/04/25 08:25
L8	2	(updat\$4 upgrad\$4) same (bank ) same code with version.clm.	US-PGPUB	OR	ON	2007/04/25 08:07
L9	46	(updat\$4 upgrad\$4) with (software firmware) with version with (bank memory ).clm.	US-PGPUB	OR	ON	2007/04/25 08:09
L10	6	shift\$4 with bank same (updat\$4 upgrad\$4).clm.	US-PGPUB	OR	ON	2007/04/25 08:10
L11	87	(updat\$4 upgrad\$4) same (memory bank storage) same code with version and (717/171 717/176 "717"/\$.ccls.)	US-PGPUB	OR	ON	2007/04/25 08:12
L12	6	(convert\$4 modif\$4 transform chang\$4) with ( bank ) same code with version and (717/171 717/176 "711"/\$.ccls.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:14
L13	37	(convert\$4 modif\$4 transform chang\$4) with ( bank memory ) same code with version and (717/171 717/176 "711"/\$.ccls.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:15

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L14	13	shift\$4 with bank same (updat\$4 upgrad\$4)and (717/171 717/176 "711"/\$.ccls.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:21
L15	5	(updat\$4 upgrad\$4) with bank same (fault adj tolerant)and (717/171 717/176 "711"/\$.ccls.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:22
L16	6	(updat\$4 upgrad\$4) with bank same (fault adj tolerant)and (717/170 717/171 717/176 "711"/\$.ccls.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:22
L17	6	(updat\$4 upgrad\$4) with bank same (fault adj tolerant)and (717/177 717/170 717/171 717/176 "711"/\$.ccls.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:23
L18	6	(updat\$4 upgrad\$4) with bank same (fault adj tolerant) and (717/177 717/170 717/171 717/176 "711"/\$.ccls.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:23
L19	30	(updat\$4 upgrad\$4) with (software firmware) with version with (bank memory )and (717/177 717/170 717/171 717/176 "711"/\$.ccls.)	US-PGPUB	OR	ON	2007/04/25 08:23
L22	47	(updat\$4 upgrad\$4) same (memory bank storage) same code with version and (717/177 717/170 717/171 717/176 "711"/\$.ccls.)	US-PGPUB	OR	ON	2007/04/25 08:26
S3	1	(updat\$4 upgrad\$4) with (software firmware) with version with (bank memory ) same (pre\$process\$4) with instruction	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:02
S4	1	(updat\$4 upgrad\$4) with (software firmware) with version with (bank memory ) same (pre\$process\$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/09/11 16:46

## EAST Search History

S5	163	(updat\$4 upgrad\$4) with (software firmware) with version with (bank memory ) and (parallel pre\$process\$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/09/11 16:46
S11	18	(convert\$4 modif\$4 transform chang\$4) with ( bank ) same code with version	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/04/25 08:12